



Complete, fold and seal
(see note 2 below)

SURNAME: *Storde*

FORENAME(S): Loughan

12 Pages

1. Please give the information requested in the boxes below.
2. Enter your name in the space provided to the right, fold over and seal down (using the label provided) to hide your name.
3. The answers must be legibly written. The Examiners can either ignore illegible script or have it typed and the expense of typing charged to the candidate.
4. Write your answers in ink.
5. Begin each answer on a fresh page. Do all rough work in the answer book and cross it through.
6. No part of this book is to be torn out; it must be handed in complete.
7. If more books than one are used, fasten them together using the tags available from the invigilator(s).
8. **Every book must be handed in. In no circumstances may answer books, used or unused, be taken out of the examination venue.**

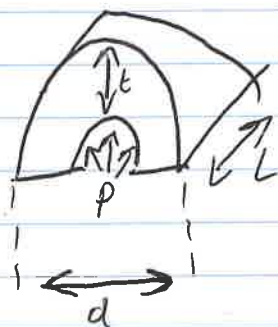
1	Student Number	P151151
2	Title of Examination Paper	CAE and stress analysis
3	Module Code	MSX02064
4	Date and Time of Examination	09/05/19 12:00pm
5	Examination Venue	SAIQ 310
6	Seat Number	G031
7	Number of Answer Books handed in	

List the numbers of the questions you have attempted	Office Use
1	8
2	7 $\frac{1}{2}$
3	8
Total	23.5

(Gweler yr ochr arall am y fersiwn Cymraeg)

39.2%



1
a

Pressure = Hoop Stress

$$P = \frac{F}{A} \quad F = PA \quad A = \pi dL$$

$$F = PD$$

$$F = \sigma A \quad F = \sigma_H 2LT$$

if $T = \frac{1}{20} d$
cylinder is
considered thin

~~$$PD = \sigma_H 2LT$$~~

$$PD = \sigma_H 2LT$$

$$PD = \sigma_H 2T$$

$$\frac{PD}{2T} = \sigma_H$$

b
#

$$\sigma_H = 200 \text{ MPa}$$

$$D = 3.5 \text{ m}$$

$$t = 0.5 \text{ mm}$$

(thin cylinder)

$$P = \rho gh$$

i)

$$\sigma_H = \frac{PD}{2t}$$

$$\sigma_H 2t = PD$$

$$\frac{\sigma_H 2t}{D \rho gh} = P$$

$$P = \rho gh$$

$$\frac{(200 \times 10^6)(2 \times 0.5 \times 10^{-3})}{3.5} =$$

$$57142.857 \text{ Pa}$$

$$57.143 \text{ kPa}$$

From table 1

maximum altitude = 15,000 ft

$$P = \rho gh$$

$$\frac{P}{\rho g} = h$$

$$\frac{57142.857}{(1.2)(9.81)} = 4854.133 \text{ m}$$

1
bii) @ 8000 ft $P = 75.3 \text{ Kpa}$ (0.0753 MPa)

$$\sigma_H = \frac{P_d}{2t}$$

$$\frac{\sigma_H 2t}{D} = P$$

$$\frac{(200.0753 \times 10^6)(2 \times 0.5 \times 10^{-3})}{3.5} = P$$

$$\cancel{5716432143 \text{ Pa}}$$

$$\cancel{57.16} \text{ MPa} \quad 57.164 \text{ Kpa}$$

$$P = \rho g h$$

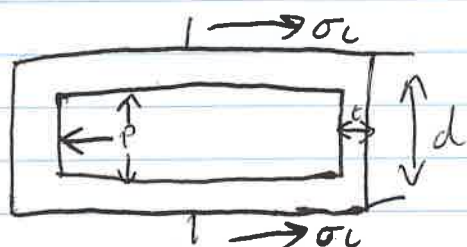
$$\frac{P}{\rho g} = h$$

$$\frac{57.164 \times 10^3}{\left(\frac{1.225}{0.74}\right)(9.81)} = \frac{7885.1356 \text{ m}}{4855.92 \text{ m}}$$

$$\frac{15931.0496 \text{ ft}}{25937.9461 \text{ ft}}$$

maximum altitude
= ~~16000 ft~~ 26000 ft

c) from Part b, the advantages of Pressurising Plane cabins is an increased altitude ceiling allowing the plane to fly ~~also~~ through thinner air thereby becoming more efficient

1
d)

long Stress = Pressure
 $P = \frac{F}{A}$ $F = PA$
 $A = \pi r^2$
 or $\frac{\pi D^2}{4}$

$$F = \frac{P \pi D^2}{4}$$

$$P = \sigma_s \quad F = \sigma_L \times \text{circumference} \times t$$

$$F = \sigma_L \times \pi D \times t$$

$$\frac{P \pi D^2}{4} = \sigma_L \pi D t$$

$$\frac{PD}{4} = \sigma_L t \quad \sigma_L = \frac{PD}{4t}$$

e) Based on the equations for Hoop stress and longitudinal stress some oils may be kept in spherical tanks due to their increased ability to withstand pressure. while others probably the more widely used oils are kept in cylindrical tanks due to their ease of storage, and ease of manufacture.

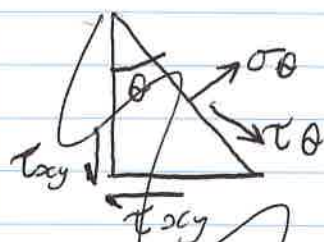
(1)

2

- a) Principal stress is the main stress being applied ~~to~~ to an object, it could also be the stress force that is being studied.

Principal Plane is the direction in which the stress is being applied

b)



$$\tau_{xy} = \tau_{\theta}$$

$$\sigma_{\theta} = \frac{1}{2}(\sigma_x + \sigma_y) + \frac{1}{2}(\sigma_x - \sigma_y)\cos 2\theta$$

$$\tau_{\theta} = \frac{1}{2}(\sigma_x - \sigma_y)\sin 2\theta$$

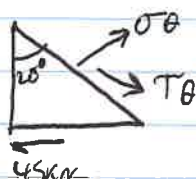
$$\tau_{xy} = \frac{1}{2}(\sigma_x + \sigma_y) + \frac{1}{2}(\sigma_x - \sigma_y)\cos 2\theta$$

$$\tau_{xy} = (\sigma_x + \sigma_y) + (\sigma_x - \sigma_y)\cos 2\theta$$

c) $800\text{mm}^2 = A$

$$\sigma_x A = 45\text{KN}$$

$$\theta = 20^\circ$$



$$\sigma_{\theta} = \frac{1}{2}(\sigma_x + \sigma_y) + \frac{1}{2}(\sigma_x - \sigma_y)\cos 2\theta$$

$$\sigma_{\theta} = \frac{1}{2}(45 \times 10^3) + \frac{1}{2}(45 \times 10^3)\cos 2(20)$$

$$\sigma_{\theta} = 39735.9997\text{N}$$

$$\sigma_{\theta} = 39.736\text{KN}$$

$$\tau_{\theta} = \frac{1}{2}(\sigma_x - \sigma_y)\sin 2\theta$$

$$\tau_{\theta} = \frac{1}{2}(45 \times 10^3)\sin 2(20)$$

$$\tau_{\theta} = 14462.22122\text{N}$$

$$= 14.463\text{KN}$$

3
a)

A Design Problem ~~is~~ ^{can occur when} ~~is~~ ^{is} made to discover a solution to a Problem, this is then Researched

A Design Problem needs to be clearly defined before it can be Researched, ~~it is then~~ multiple solutions can then be found before being analysed, an analysis problem may then occur if the design fails to meet the criteria set ~~out~~ in the original solution to the Problem.

3

b)

a design Problem is usually iterative because it ~~cannot~~ ^{cannot} progress through the design Procedure if it fails to meet all the predetermined criteria. An analysis problem however can ~~also~~ be solved by splitting it into smaller parts, these parts ~~can~~ ^{can} then be analysed one after the other in a sequential order. The differences are best illustrated using the following methods.

Split the Problem into smaller elements

Interpret the Geometry

Material characteristics

Physical Properties

Loading

Evaluation of Results

This is the simple acronym.

The second method involves taking 5 steps to solve. (shown on next page)

- ① Define the Problem
- ② Research the Problem
- ③ Find multiple solutions
- ④ Analyse the solutions to isolate the best one
- ⑤ Test and Implement the Selected Solution.

e) ~~the solution is not unique~~

(5)

Question No.

Examiner Only

Question No.

Examiner On

Arholwr yn unig

Unit y Cwestiwn

Question No.

Examiner Only

Question No.

Examiner Only

Arholwr yn unig

Yn unig y Cwestiwn

Question No.

Examiner Only

Arholwr yn unig

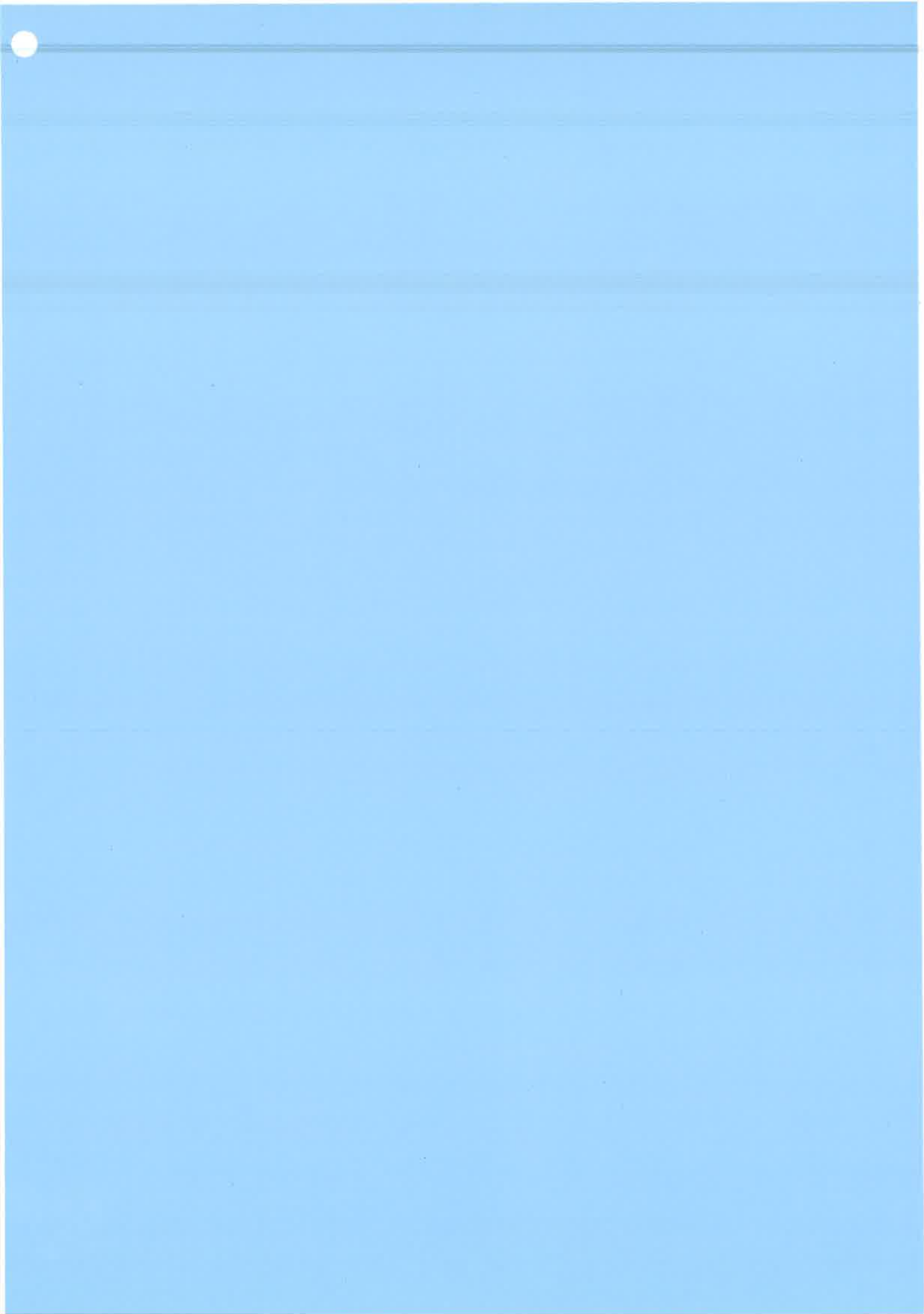
Rhif y Cwestiwn

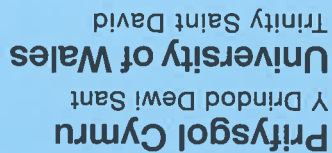
Question No.

Examiner Only

Arholwr yn unig

Y Cwestiwn





Cyfarwyddiadau i Ymgeiswyr

1. Rhwch yr holl wybodaeth y gofynnir amdani yn y blychau isod.
2. Rhwch eich enw yn y lle a ddarparwyd ar y dde, plygwch ef a'i seilio i lawr (gan ddefnyddio'r label a ddarparwyd) i guddio'ch enw.

3. Rhaid i'r atebion fod mewn llawysgriften ddarlennadwy. Gall yr Arholwyr naill ai anwybyddu sgrïpt annarllennadwy, neu drefnu iddi! gael ei theipio a chael yr ymgeisydd i dalu.

4. Ysgirfennwch eich atebion mewn inc.
5. Dechreuwch bob ateb ar dudalen newydd. Gwnewch unrhyw fras nodiadau yn y llyfr atebion a thynnu llinell drwyddynt.
6. Ni ddylid rhwygo unrhyw ran o'r llyfr hwn; rhaid ei gyflwyno yn gyfan.
7. Os defnyddir mwy nag un llyfr, rhwymwch hwy gyda'i gilydd gan ddefnyddio'r tagiau sydd ar gael oddi wrth y gwyllwyr/gwylwyr.
8. Rhaid dychwelyd pob llyfr. Ni chaniateir mynd â llyfrau atebion, wedi eu defnyddio neu heb eu defnyddio, allan o'r lleoliad arholi o dan unrhyw amgylchiadau.

7	Nifer y Llyfrau Atebion a gyflwynwyd	
6	Rhif Sedd	
5	Lleoliad yr Arholiad	
4	Dyddiad ac Amser yr Arholiad	
3	Cod y Modwl	
2	Teitl y Papur Arholiad	
1	Rhif Myfyrwr	

[illegible]

(See the other side for English version)

Llenwch, plygwh a seliwch
(gweler nodyn 2 isod)

CYFENN:

ENW(AU) CYNTAF:

ENW(AU) CYNTAF: